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BOOK REVIEWS

Elementary Quantitative Analysis

W. J. Blaedel and *V. W. Meloche*, both of the University of Wisconsin, Madison. 2nd ed. Harper and Row, Publishers, New York, *1963*. xi + *964 pp. Figs.* and tables. 16.5 × 23.5 cm. $9.60

An excellent text has been improved in this Second Edition, although the review of the First Edition (J. CHEM. EDUC., **34,** A283 [1957]) could be repeated almost verbatim. The most important change is the addition of an extensive chapter on Complexation Titrations. The authors are to be commended on their development of complex equilibria and their graphic presentation of the advantages of chelons in analytical chemistry.

Other major changes include: addition of an experiment on potentiometric determination of chloride, addition of a large number of questions and problems to an already impressive collection, exclusive use of the Brønsted treatment in acid-base equilibria (formerly in Supplement), and expansion and updating of the literature references.

Minor changes include: use of larger type for headings, removal of asterisks from more difficult problems (confusion remains with two or more problems on the same page with the same number), numerical changes in the data in many problems, revision of material on growth of crystals and purity of precipitates, balancing of redox equations with half reactions (formerly in Supplement), addition of material on mechanism of redox reactions to the Supplement, omission of the quinhydrone electrode, emphasis on spectrophotometry instead of simple colorimetry, etc.

In spite of these obvious improvements, this reviewer feels more critical of this edition than the first. It is now six years later, and we are still assumed to be teaching essentially the same material as 20 years ago. In other divisions of chemistry, radically new approaches have appeared which reflect the advance of chemistry. While this book is at the top of the list of traditional texts, it fails to give an adequate presentation of current analytical chemistry. For example, the table on page 13, "A Survey of Analytical Publications on Various Methods of Measurements," is out of date. Yet the balance of emphasis in this text is even farther behind the times. With over 900 pages at their disposal and a wealth of other texts to improve upon, the authors might have produced a masterpiece—and they have! But in 1963, why are visible spectrophotometry, potentiometry, and complexation titrations still relegated to "Special Topics"? Where are ion exchange, solvent extraction, various kinds of chromatography, ultraviolet and infrared spectrophotometry, electrochemical methods, radio-counting techniques? The argument for their omission given by the authors in Chapter 22 is not convincing. On page 540, methods based on thermal properties (e.g., DTA and GC detectors) are dismissed with the notation, "not *frequently used, but frequently valuable*"—the same statement made in the first edition. At this level one does not expect an exhaustive treatment, but there must be some overview of all analytical techniques and the kinds of information they can supply other than straight forward analysis of samples. This is especially true as the time devoted to analytical chemistry must diminish and most students will not take another analytical course.

The above remarks apply to most of the recent texts on elementary analysis. This is a superb source of information for the limited area it is intended to cover, and will be welcomed by all teachers who are giving a traditional course at the sophomore level.

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Reviewed in this Issue

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Koji Nakanishi, Infrared Absorption Spectroscopy
M. F. Lappert and *G. J. Leigh*, editors, Developments in Inorganic Polymer Chemistry
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John G. Hawthorne and *Cyril S. Smith*, translators, On Divers Arts: the Treatise of Theophilus
Ernst Jucker, editor, Progress in Drug Research. Volume 4
B. L. Horecker, Pentose Metabolism in Bacteria
Paul Pascal, editor, Nouveau Traité de Chimie Minerale. Volume 20, Alliages Métalliques, Part 2

Fundamentals of Analytical Chemistry

Douglas A. Skoog, Stanford University, Stanford, California, and *Donald M. West*, San Jose State College, San Jose, California. Holt, Rinehart, and Winston, New York, 1963. xii + 786 pp. Figs. and tables. 15.5 × 23.5 cm. $8.50.

This text is aimed primarily at sophomore-level chemistry students, and stresses "an appreciation for the over-all analytical process." The book consists of two major portions. The first includes topics generally considered as classical analytical methods, containing sections entitled Introduction, Gravimetric Analysis, and Volumetric Analysis, and accounts for about two-thirds of the book. The remaining portion of the book treats electrical and optical methods of analysis, and several miscellaneous topics, including sampling, attack of samples, and separations. Although the preface states the authors aim to emphasize similarities between classical and instrumental methods, there is very little connection between these two main sections of the book.

In general, the book stresses practical techniques and analytical calculations rather than fundamental chemical principles. The approach has been to compile a large number of determinations and reactions, but to discuss few in any detail. For example the book contains a most comprehensive listing of determinations based on oxidation-reduction titrations, including those based upon titrants such as bromate, periodate and chromous ions. On the other hand, the induced reaction of chloride ion and permanganate during the well-known titration of iron is only mentioned, induced reactions are not defined, and the mechanism of the reaction and the function of the Zimmermann-Reinhardt solution are not discussed. Titrations based on complex-formation reactions are described, including the use of EDTA as a titrant, but only two pages are devoted to a discussion of what a complex ion is, how it is formed, chelate compounds, instability constants, etc. The discussion of equilibria calculations and especially acid-base titration curves is very good, although the use of Arrhenius (hydrolysis) rather than Brønsted concepts in the calculations is disappointing.

The second portion of the book is intended for a second semester course, but really only covers a portion of what is modern instrumental analysis. This reviewer, an electroanalytical chemist, questions the prevailing practice of writers of elementary quantitative analysis texts of devoting a large portion of their books to the relatively complex subject of electroanalytical chemistry, to the almost complete exclusion of many easily understood and widely used techniques. For example this text devotes 126 pages to electroanalytical methods, but only two pages to gas chromatography. Some of the more esoteric topics, such as differential potentiometric titrations and kinetic and catalytic currents in polarography, might have been left to monographs. Similarly discussions of overpotential and diffusion presented to students before they have had physical chemistry, seems unwise.

The book contains about 400 problems and numerous references to the literature, including a good brief description of the literature of analytical chemistry. In general the book is carefully and clearly written with few errors of fact. One misstatement repeated several times concerns the standard potential of the standard hydrogen electrode, which is defined as zero at all temperatures, not only at 25°. The figures are good, and the price seems reasonable. The book certainly deserves consideration as a text for a course stressing practical analytical chemistry and a detailed survey of analytical methods.

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Analytical Chemistry, 1962: The Proceedings of the International Symposium held at Birmingham University, April, 1962.

Edited by *Philip W. West*, Louisiana State University, Baton Rouge, and *A. M. G. MacDonald* and *T. S. West*, University of Birmingham, England. American Elsevier Publishing Co., New York, 1963. x + 411 pp. Figs. and tables. 17 × 24.5 cm. $16.

The 1962 International Symposium on Analytical Chemistry was held in honor of Fritz Feigl to commemorate his 70th birthday. For this reason, a considerable portion of the meeting was devoted to spot test and the role of organic reagents in analytical chemistry. The papers in this area vary in scope and treat such general topics as oxidation potentials in qualitative analysis or specific subjects such as Vic-Dioximes as analytical reagents. Some papers dealing with spot analysis seem to be designed to discuss the present status of a general area such as the detection of pharmaceutical products by spot test reactions.

There are sections of this work which deal with subjects such as electrochemical, radiochemical, and optical methods of analysis. Topics of current interest such as atomic absorption spectroscopy, differential electrolytic potentiometry, and cathode ray polarography are treated by outstanding research workers in these fields.

There are small sections dealing with separation processes and titrimetric analysis and miscellaneous topics.

Although the papers, of necessity, are short coupled with the printed discussion of the paper, they are quite worthwhile. This book will be most useful as a library reference for persons attempting to catch up on the recent developments during the past two years in the areas mentioned.

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Quantum Theory of Molecules and Solids. Volume 1, Electronic Structure of Molecules

John C. Slater, MIT. McGraw-Hill Book Co., Inc., New York, 1963. Figs. and tables. xv + 485 pp. 16.5 × 23.5 cm. $12.50.

This book represents a further installment of Professor Slater's magnum opus, a general account of the quantum theory of atoms, molecules, and solids. Having treated atomic structure in a two-volume work which appeared in 1960, he has now embarked on an account of the quantum theory of molecules. This volume, the first of the new series, deals with the methods currently available for treating molecular structure, and with their application to some specific problems.

The general construction of the book follows a conventional pattern. The first four chapters deal with the hydrogen molecule and molecule ion, the fifth describes the MO method including the Roothaan SCF treatment, the next two chapters discuss homonuclear and heteronuclear diatomic molecules, chapter eight deals with group theory and symmetry properties of wave functions, chapter nine with Bloch's method for constructing symmetry orbitals together with an introduction to the theory of solids, and the last three chapters deal with ammonia, methane, water, ethylene, and benzene.

The appearance of any book by Professor Slater is always a notable event; there is really no need for the reviewer to say more about this one than that it is well up to his highest standards. It is concise, clear, stimulating, and (as one would expect) full of original ideas and observations; it is also a joy to read. Much of this clarity comes from its construction; the main text occupies little more than half the book, being followed by 146 pages of appendices dealing with mathematical details, ranging from the Virial Theorem and Group Theory to the calculation of molecular integrals. As a bonus there is an extremely comprehensive 80-page bibliography which alone would be worth the price of the whole book—which in any case is most reasonable.

This book is a "must" for anyone with any interest in quantum chemistry. One can only hope that the following volumes will appear in quick succession and that they will be equally good—they could hardly be better.

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Nuclear Physics and the Fundamental Particles

Harry H. Heckman, Lawrence Radiation Laboratory, University of California, Berkeley, and *Paul W. Starring*, Lodi High School, Lodi, California. Holt, Rinehart, and Winston, Inc., New York, 1963. vi + 410 pp. Figs. and tables. 15.5 × 23.5 cm. Paperbound. $0000.

This paper-back volume for "capable high school students" was written at the request of a group of teachers who had participated in the summer lecture-research program at the Lawrence Radiation Laboratory of the University of California. Many of these teachers felt there was a great need for a text written for high school students which would "both recast and elaborate on the subject of the physics of the nucleus and the fundamental particles." Physicist Heckman of the Lawrence Radiation Laboratory and high school teacher Starring have teamed up to collect in a single volume, a body of information which has hitherto been available largely in college texts on nuclear physics or in the periodical and research literature.

In the opinion of the reviewer the *average* high school student will find this volume difficult. On the other hand the capable student with a good grasp of mathematics will breeze through it and wish that the authors had filled in the gaps in spots where they have indicated, "Using the calculus it is possible to show that . . . ."

The treatment is then, essentially nonmathematical, meaning that only algebraic arguments are used. There is an obvious temptation on the part of the authors to lapse into a bit of calculus here and there, but on the whole they have shown remarkable restraint.

The early chapters deal with atomic structure, basic properties of nuclei and nuclear models, followed by radioactive nuclei, interactions of radiation with matter, particle accelerators and detection of radiation. The next few chapters deal with unstable particles (neutrons, pions, and muons), with strange particles (K mesons and hyperons) and with antiparticles. Finally there are chapters on space physics (cosmic rays and the Van Allen belts) and health physics.

Each chapter has a set of review questions, as well as work problems and calculations. Answers are given to alternate problems. The Appendix includes a glossary of units, symbols and abbreviations, a table of physical constants and conversion factors, and a table of fundamental particles. A table of isotopic masses is not included.